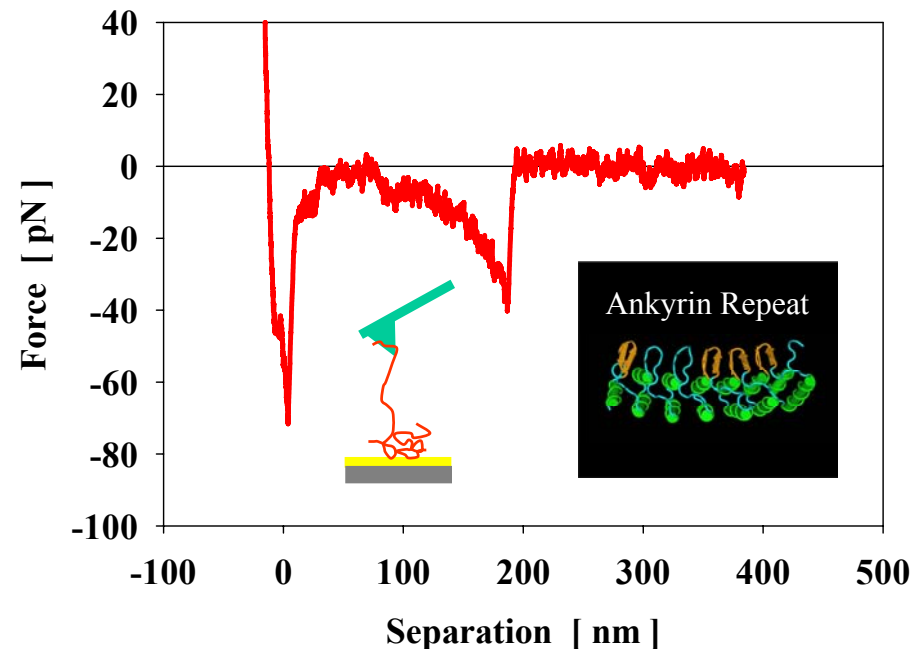


Recent Research Activities

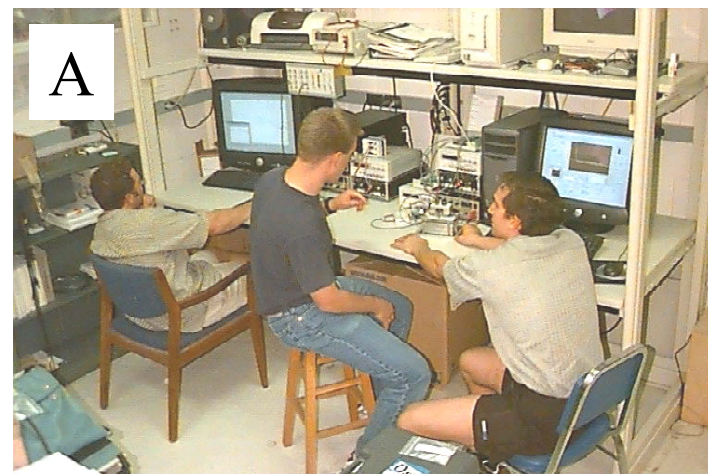
1. **Force Spectroscopy of Stimulus-Responsive Polymers** (Zauscher and Chilkoti)
2. **Nanoscopic Study of Aging in Intergranular Contacts** (Hueckel and Zauscher)
3. **Structure and Dynamic Properties of Reversible Materials at the Nanometer Scale** (Craig)
4. **Force-Extension Behavior of Ankyrin** (Bennett, Zauscher and Clark)

Ankyrins are modular, multifunctional membrane adapter proteins that have the potential to couple diverse membrane proteins to the spectrin-based membrane skeleton (1) and play an important role in cell signaling. The amino-terminal membrane binding domain of ankyrin is composed of 24 ANK repeats, folded into six-repeat subdomains. Each repeat is composed of two adjoining α -helices connected by a randomly coiled loop (Inset Figure A). With our force spectrometer we are able to study ankyrin's force induced unfolding behavior (Figure A) on the single molecule level to elucidate its potential role in mechanical signal transduction. (1) Bennett, *Curr. Op. Cell Bio.*, 13:61, 2001; Bennett, *Physiological Rev.*, 81:1353, 2001)



Education and Student Involvement

This project initiated a new, interdisciplinary activity in instrument development that is tied closely to our current and future education and research goals. The activity provides Duke University with several state-of-the-art instrument for molecular force measurements. The project currently involves 3 graduate students tasked with instrument development. **Figure A: Graduate students Doug Kieweg (middle) and Alexei Valiaev (right) discussing details of instrument control.**



The demonstrated success in designing and constructing the spectrometer has led to “know-how” that is currently applied in the construction of a scanning probe microscope for nanolithography.

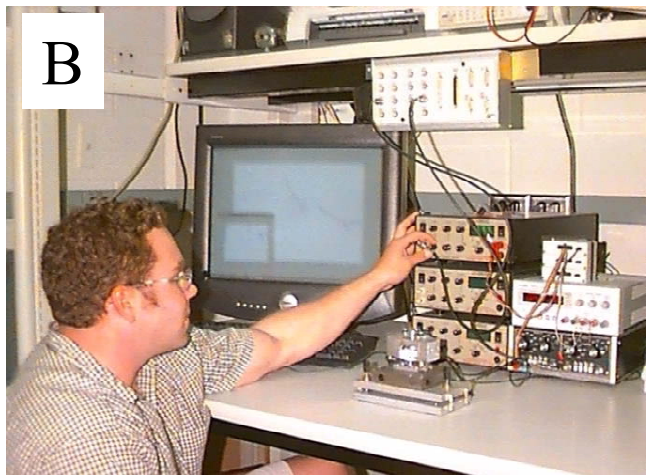


Figure B: Graduate student Matt Johannes testing the the X-Y positioning stage of the new nanolithography instrument.

The project also provides training opportunities for Duke undergraduate engineering students. For example, Miss Amanda Peters was tasked with producing computer aided design drawings to facilitate the machining of parts, and Mr. Matt Ptak encoded operation protocols and data reduction programs in MatLab®.